

STONEFLIES (PLECOPTERA) OF THE POWDERMILL NATURE RESERVE, SOUTHWESTERN PENNSYLVANIA¹

Scott A. Grubbs²

ABSTRACT: Species richness and flight records of Plecoptera occurring in the Powdermill Nature Reserve, southwestern Pennsylvania, are reported following (1) an extensive four-year (1991-1995) survey of a broad range of lotic habitats; and (2) inclusion and examination of historical collections (1956-1988). Overall, 52 species are recorded from Powdermill, including 7 species based solely on the historical collections. Three new state records (*Allocapnia harperi*, *Leuctra alexanderi*, and *Alloperla aracoma*) increase the number of species reported from Pennsylvania to 117. Notes on the local and regional distribution of individual species are provided.

The Powdermill Nature Reserve, the biological field station of the Carnegie Museum of Natural History (Pittsburgh), is located in the Allegheny Mountain Section of the Appalachian Plateaus Province of eastern North America (Berg *et al.*, 1989). Powdermill presently occupies nearly 900 hectares in the Laurel Mountains, Westmoreland County, southwestern Pennsylvania.

Previous surveys of the aquatic insect fauna of the Powdermill Nature Reserve have focused mainly on Trichoptera (Sykora *et al.*, 1976, Sykora and Weaver, 1978, Weaver and Sykora, 1979, Weaver, 1988) and Chironomidae (W. P. Coffman, University of Pittsburgh, unpublished data). The reserve contains the type localities for a recently-discovered species of Plecoptera (*Soyedina merritti* Baumann and Grubbs, 1996) and two species of Trichoptera (Sykora and Weaver, 1978). However, most aquatic groups (e.g. Ephemeroptera, Plecoptera prior to this study, Diptera other than Chironomidae) have been poorly studied despite the wide array of protected, high-quality habitats located in the reserve. In light of this, the primary objective of this study was to extensively survey the adult stonefly fauna from the broad range of habitats located in the Powdermill Nature Reserve.

STUDY SITES and COLLECTION METHODS

Fresh adult stoneflies were collected from 14 lotic habitats during a four-year period from April 1991 - July 1995. Habitats ranged from seeps and springs to a 4th-order stream (largest lotic habitat at Powdermill). Stream sediments in each habitat are dominated by cobbles and gravel, and each habitat is lined by a complete riparian canopy. Common woody flora within the reserve include tulip poplar (*Liriodendron tulipifera* L.), American beech (*Fagus grandifolia*

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² Department of Biological Sciences, University of Pittsburgh, Pittsburgh, PA 15260.

Ehrh.), eastern hemlock (*Tsuga canadensis* [L.]), sugar maple (*Acer saccharum* Marsh.), red maple (*A. rubrum* L.), yellow birch (*Betula alleghaniensis* L.), black birch (*B. lenta* L.), northern red oak (*Quercus rubra* L.), white ash (*Fraxinus americana* L.), black cherry (*Prunus serotina* Ehrh.), witch hazel (*Hamamelis virginiana* L.), and shagbark hickory (*Carya ovata* [Mill.]).

Adults were collected by (1) visually searching cobbles and boulders, leaf packs and woody debris, tree trunks and intact green leaves, herbaceous annuals and perennials, and bridges; (2) beating riparian vegetation; (3) light-trapping; and (4) transporting live nymphs to the University of Pittsburgh and rearing in Living Streams® (Frigid Units, Inc).

In addition, stoneflies were examined from the Section of Invertebrate Zoology, Carnegie Museum of Natural History (CMNH). Published records (Stark and Szczytko, 1988) and additional records provided by Dr. R. W. Baumann (Brigham Young University) and Dr. R. F. Surdick were also included. Each latter collection is designated as historical because they were based on material collected between 1956 and 1988.

RESULTS and DISCUSSION

A grand total of 2176 fresh adult stoneflies were collected and identified, encompassing 43 species (Table 1). Two additional species were collected only as nymphs and exuviae (*Clioperla clio*) or nymphs (*Cultus* sp.). The historical collections provided records of 30 species based on 99 specimens. Overall, 52 species were recorded (fresh + historical) from Powdermill, encompassing 31 genera and all nine Nearctic families (Table 1). Seven species (*Megaleuctra flinti*, *Soyedina vallicularia*, *Alloperla usa*, *Rasvena terna*, *Utaperla gaspesiana*, *Diploperla duplicata*, and *Perlesta* sp. A) were represented solely by historical records.

Thirty-seven species display distribution patterns endemic to the Appalachian Mountains. An additional 15 species exhibit widespread boreal distributions, occurring primarily east of the Rocky Mountains. The Capniidae, Leuctridae, Nemouridae, and Chloroperlidae were the best represented families, owing to large collected numbers of *Allocapnia* spp. and *Paracapnia angulata*, *Leuctra* spp. and *Paraleuctra sara*, *Amphinemura* spp. and *Ostrocerca* spp., and *Sweltsa* spp., respectively. Nine genera were represented by multiple species, including *Leuctra* (7), *Allocapnia* (5), *Amphinemura* (3), *Isoperla* (3), and *Sweltsa* (3).

The highest species richness recorded for any single habitat was a 3rd-order stream (37). This probably indicates an artifact of sampling effort, however, because this habitat was represented by the highest proportion of freshly-collected specimens (44%). Seeps supported the lowest species richness, containing mainly *Allocapnia harperi*, *Ostrocerca truncata*, *Soyedina merritti*, and *Peltoperla arcuata*. All eastern North American species of *Ostrocerca* spp. have

been previously considered to be a rare group of Appalachian stoneflies (Kondratieff and Kirchner, 1987). Both Powdermill species, however, are particularly abundant in seeps (*O. truncata*) and springs and 3rd-order streams (*O. albidipennis*).

Numerous species (*Allocapnia zola*, *Strophopteryx fasciata*, *Clioperla clio*, and *Pteronarcys biloba*) were only obtained from low-gradient reaches of 3rd- and 4th-order streams. Each habitat occurs adjacent to, or downstream of, pasturelands and contains a greater silt content than any other sampled habitat. Similarly, *Amphinemura delosa* was mainly collected from the above-mentioned habitats whereas *A. nigritta* and *A. wui* were primarily encountered in moderate-gradient springs and 3rd-order streams. In contrast, five species (*Allocapnia harperi*, *A. nivicola*, *Paracapnia angulata*, *Ostrocerca albidipennis* and *Soyedina merritti*) were collected from the broadest range of habitats (seeps to 3rd- and 4th-order Powdermill Run).

Three species, *Allocapnia harperi*, *Alloperla aracoma*, and *Leuctra alexanderi* represent new state records. Two (*Allocapnia harperi* and *Alloperla aracoma*) represent range extensions and the northern-most records for each species. *Allocapnia harperi* is apparently endemic to the southern and central Appalachians and has been previously recorded only from Virginia (Kirchner, 1980, Kondratieff and Kirchner, 1991) and West Virginia (Kirchner, 1982). Kondratieff and Kirchner (1991) listed the status of *A. harperi* in Virginia as special concern. *Alloperla aracoma* appears to be endemic to the central Appalachians and has been previously collected only from a few localities in West Virginia (Harper and Kirchner, 1978, Griffith and Perry, 1992). *Leuctra alexanderi* is also apparently endemic to the southern and central Appalachians and had been previously recorded as far north as northern West Virginia (Griffith and Perry, 1992). I have also collected *L. alexanderi* in northwestern Pennsylvania (Crawford Co., seep in Tryon-Webber Woods Natural Area, Western Pennsylvania Conservancy, 6 June 1994, 3 males, 3 females), which represents the northern-most record to date (P.P. Harper, Université de Montreal, personal communication). In addition, *Soyedina merritti* was recently described from material collected from seeps and springs in the Powdermill Nature Reserve and one additional habitat in the Laurel Mountains (Baumann and Grubbs, 1996). *Soyedina merritti* may be endemic to the central Appalachians.

Earle (1994) added 14 new records to Pennsylvania, and updated the earlier lists of Surdick and Kim (1976), Stark *et al.* (1986), and Stewart and Stark (1988), to bring the total number of species recorded in the state to 113. The three additions reported in this paper, plus *Soyedina merritti*, increase the total to 117 species.

Table 1. Flight records of Plecoptera from the Powdermill Nature Reserve based on fresh (1991-1995) and historical (1956-1988) collections. X = collected as adults; E = collected as exuviae; N = collected as nymphs. AP = Appalachian, CP = Coastal Plain, and WB = widespread-boreal distributed species. * new state record; # total number of specimens collected, examined, or included; () number of specimens based on historical collections only.

Species	4th-order stream	3rd-order streams	2nd-order springs	1st-order springs	seeps	no site specified ¹	Dates collected	#
Capniidae								
<i>Allocapnia frisoni</i> (Ross and Ricker): AP	X						13 Dec - 14 Feb	16
<i>A. harperi</i> Kirchner*: AP	X		X	X			29 Jan - 4 Apr	16
<i>A. nivicola</i> (Fitch): WB	X	X	X	X	X	X	29 Dec - 24 Apr	207 (1)
<i>A. recta</i> (Claassen): WB	X	X					13 Dec - 7 Mar	21
<i>A. zola</i> (Ricker): AP	X	X					27 Jan - 27 Feb	14 (1)
<i>Paracapnia angulata</i> Hanson: WB	X	X	X	X	X		27 Feb - 4 May	342
Leuctridae								
<i>Leuctra alexanderi</i> Hanson*: AP	X	X			X		13 June - 19 July	3
<i>L. duplicata</i> Claassen: AP		X					20 May	1
<i>L. ferruginea</i> (Walker): WB	X	X	X				24 June - 13 Dec	157
<i>L. grandis</i> Banks: AP		X	X	X			10 May - 13 June	87
<i>L. sibleyi</i> Claassen: AP	X	X	X			X	10 May - 12 June	73 (3)
<i>L. tenella</i> Provancher: WB		X	X				13 May - 23 June	93
<i>L. tenuis</i> (Pictet): WB		X					18 July	5 (4)
<i>Megaleuctra flintii</i> Baumann ¹ : AP				X			15 May - 21 May	7 (7)
<i>Paraleuctra sara</i> (Claassen): AP	X	X	X	X			27 Mar - 4 May	121
Nemouridae								
<i>Amphinemura delosa</i> (Ricker): WB	X	X				X	11 May - 18 July	20 (8)
<i>A. nigritta</i> (Provancher): WB		X		X		X	20 May - 18 July	57 (9)
<i>A. wui</i> (Claassen): AP		X	X	X			20 May - 31 Aug	76
<i>Ostrocerca albidipennis</i> (Walker): AP		X	X	X			4 May - 17 July	138
<i>O. truncata</i> (Claassen): AP		X	X	X	X		26 Apr - 16 May	39
<i>Paranemoura perfecta</i> (Walker): AP			X		X		4 Apr - 1 May	10
<i>Prostoia similis</i> (Hagen): WB		X					3 May	1
<i>Soyedina merritti</i> Baumann ¹ and Grubbs: AP		X	X	X	X	X	14 Mar - 3 May	36 (2)
<i>S. vallicularia</i> (Wu) ¹ : WB						X	14 Mar	1 (1)
Taeniopterygidae								
<i>Oemopteryx contorta</i> (Needham and Claassen): AP		X	X	X			17 Mar - 3 May	12
<i>Strophopteryx fasciata</i> (Burmeister): WB	X	X				X	27 Feb - 24 Apr	6 (3)
<i>Taeniopteryx maura</i> (Pictet): WB	X	X				X	24 Feb - 15 Apr	119 (7)

Species	4th-order stream	3rd-order streams	2nd-order springs	1st-order springs	seeps	no site specified ¹	Dates collected	#
Pteronarcyidae								
<i>Pteronarcys biloba</i> Newman: AP	X						24 May - 5 June	2 (1)
<i>P. proteus</i> Newman: AP		X	N				22 May - 4 June	4 (1)
Peltoperlidae								
<i>Peltoperla arcuata</i> Needham: AP		X	X	X	X	X	17 May - 11 Aug	19 (7)
<i>Tallaperla maria</i> (Needham and Smith): AP	X	X	X				11 May - 24 June	94 (3)
Perlodidae								
<i>Clioperla clio</i> (Newman): WB	N,E						22 April (exuviae)	0
<i>Cultus</i> sp.: AP	N						nymphs only	0
<i>Diploperla duplicata</i> (Banks) ¹ : AP, CP					X		23 May	1 (1)
<i>Isoperla holochlora</i> (Klapalek): AP	X		X	X	X		2 June - 14 Sept	13 (3)
<i>I. montana</i> (Banks): AP	X			X	X		1 June - 19 July	2 (1)
<i>I. similis</i> (Hager): AP	X	X		X	X		1 May - 6 June	8 (1)
<i>Malerikus iroquois</i> Stark and Szczytko: AP	X		X				29 May - 19 June	7 (2)
<i>Remenus bilobatus</i> (Needham and Claassen): AP	X				X		6 June - 3 Aug	5 (3)
<i>Yugus bulbosus</i> (Frison): AP	X		N	N			14 May - 11 June	4
Chloroperlidae								
<i>Alloperla aracoma</i> Harper and Kirchner*: AP	X						2 June - 11 July	6
<i>A. usa</i> Ricker ¹ : AP			X				11 June - 23 July	6 (6)
<i>Haploperla brevis</i> (Banks): WB	X		X	X			23 May - 5 Aug	21 (1)
<i>Rasvena terna</i> (Frison ¹): AP				X	X		20 May	2 (2)
<i>Suwallia marginata</i> (Banks): AP	X		X				11 July - 11 Aug	29
<i>Sweltsa lateralis</i> (Banks): AP	X		X	X			11 May - 19 July	149 (2)
<i>S. naica</i> (Provancher): AP	X		X				10 May - 15 June	117
<i>S. onkos</i> (Ricker): AP	X		X	X	X		10 May - 20 July	87 (2)
<i>Utaperla gaspesiana</i> Harper and Roy ¹ : AP			X				20 May	1 (1)
Perlidae								
<i>Acroneuria abnormis</i> (Newman): WB	X				X		14 June - 10 Aug	8 (6)
<i>A. carolinensis</i> (Banks): AP	X	X			X		5 June - 20 July	5 (3)
<i>Perlesta</i> sp. A ² : AP		X			X		31 July - 26 Aug	7 (7)

¹ historical records only.² *Perlesta* sp.A is an undescribed species and a formal description is pending.

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